WE CLAIM:

1. A display comprising:

an image-producing flat-panel component having a multiplicity of imaging lines for producing an image, each imaging line being regularly updated to provide light that produces part of the image; and

a set of shutter strips, each (a) associated with at least one of the imaging lines, (b) situated in front of each so-associated imaging line outside the image-producing component, and (c) being switched during operation of the display between a light-transmissive state and a light-absorptive state such that each shutter strip is in its light-transmissive state at least partly while each imaging line associated with that strip is providing light for creating the image.

2. A display as in Claim 1 wherein each shutter strip (a) transmits at least a portion $P_{T\text{-}TS}$ of incident visible light provided from each imaging line associated with that strip when it is in its light-transmissive state and (b) absorbs at least a portion $P_{A\text{-}AS}$ of incident visible light provided from outside the display when that strip is in its light-absorptive state, $P_{T\text{-}TS} + P_{A\text{-}AS}$ being greater than 1.

3. A display as in Claim 2 wherein each shutter strip transmits up to a portion $P_{T\text{-}AS}$ of incident visible light provided from outside the display, $P_{T\text{-}TS} - P_{T\text{-}AS}$ being at least 0.1.

4. A display as in Claim 1 wherein each shutter strip outwardly appears dark when it is in its light-absorptive state.

5. A display as in Claim 1 wherein largely all of the image part produced by the light provided by each imaging line is displayed largely simultaneously.

6. A display as in Claim 1 wherein:

each imaging line is selectively activated to provide light which produces that imaging line's part of the image; and

each shutter strip is in its light-transmissive state at least largely while each imaging line associated with that strip is activated.

7. A display as in Claim 6 wherein, during operation of the display, each shutter strip is also in its light-transmissive state largely when each activated imaging line associated with that strip is essentially fully black.

8. A display as in Claim 6 wherein, during operation of the display, a variably selectable plurality of consecutive ones of the shutter strips are simultaneously in their light-transmissive states when at least one other of the shutter strips is in its light-absorptive state.

9. A display as in Claim 8 wherein the selectable plurality of shutter strips are simultaneously in their light-transmissive states when a variably selectable one of the imaging lines associated with that plurality of shutter strips is activated and each other imaging line associated with that plurality of shutter strips is deactivated.

10. A display as in Claim 6 wherein:

the imaging lines are selectively activated in response to a multiplicity of selection signals; and

the shutter strips switch between their light-transmissive and light-absorptive states largely in response to the selection signals or/and at least one selection generation signal utilized in generating the selection signals.

11. A display as in Claim 10 wherein:

each imaging line becomes activated when a different corresponding one of the selection signals goes to a selection condition and becomes deactivated when the corresponding selection signal leaves its selection condition;

no more than part of the selection signals are simultaneously at their selection conditions at any time during normal operation of the display; and

each shutter strip is in its light-transmissive state at least largely while the selection signal for each imaging line associated with that strip is at that selection signal's selection condition.

12. A display as in Claim 11 wherein substantially only one of the selection signals is at that selection signal's selection condition at any time during normal operation of the display.

13. A display as in Claim 12 wherein each imaging line emits light in response to radiation that impinges selectively on light-emissive material of that imaging line.

14. A display as in Claim 13 wherein the light-emissive material comprises phosphor.

15. A display as in Claim 11 wherein one of the shutter strips is in its light-transmissive state while the selection signal for each imaging line associated

with that shutter strip is not at that selection signal's selection condition.

16. A display as in Claim 10 further including a control component for selectively placing the shutter strips in their light-transmissive and light-absorptive states in response to the selection signals or/and each selection generation signal.

17. A display as in Claim 16 wherein the control component comprises a group of control elements for selectively providing light that determines placement of the shutter strips in their light-transmissive and light-absorptive states.

18. A display as in Claim 17 wherein each control element is operable to provide light that causes an associated one of the shutter strips to be in a specified one of its light-transmissive and light-absorptive states.

19. A display as in Claim 17 wherein the light provided by the control elements comprises part of the light provided by the imaging lines.

20. A display as in Claim 6 wherein each imaging line comprises a line of laterally separated imaging elements.

SUB A2 CONCL.

21. A display as in Claim 6 wherein each imaging element is light emissive.

22. A display as in Claim 21 wherein each imaging element emits light in response to radiation that impinges selectively on light-emissive material of that imaging element.

23. A display as in Claim 22 wherein the light-emissive material comprises phosphor.

24. A display as in Claim 22 wherein the radiation comprises electrons.

25. A display as in Claim 21 wherein each imaging element emits light in response to a potential across material of that imaging element.

26. A display as in Claim 20 wherein each imaging element comprises a light valve.

27. A display as in Claim 26 wherein each light valve includes means for providing light selectively transmitted by that light valve.

28. A display as in Claim 1 wherein:

the imaging lines are regularly updated in response to a multiplicity of selection signals; and

the shutter strips switch between their light-transmissive and light-absorptive states largely in response to the selection signals or/and at least one selection generation signal utilized in generating the selection signals.

29. A display as in Claim 28 wherein each imaging line continues to produce its updated part of the image largely until that imaging line's part of the image is updated again.

Sub B2

30. A display as in Claim 1 wherein the image-producing component has first and second plate structures spaced apart from, and extending generally parallel to, each other in an active display region.

31. A display as in Claim 30 wherein the plate structures are generally flat.

32. A display as in Claim 30 wherein the image-producing component comprises a generally flat cathode-ray tube display in which the first and second plate structures respectively comprise an electron-emitting device and a light-emitting device.

33. A display as in Claim 32 wherein:

each imaging line comprises a line of laterally separated light-emissive imaging elements of the light-emitting device; and

the electron-emitting device emits electrons that selectively strike the light-emissive imaging elements and cause them to emit light that produces the image.

34. A display as in Claim 1 wherein the image-producing component comprises one of:

a generally flat cathode-ray tube display;

a generally flat liquid-crystal display;

a generally flat plasma display;

a generally flat electroluminescent display;

a generally flat light-emitting diode display;

and, aside from the preceding displays,

a further generally flat display in which the imaging lines comprise phosphor which selectively emits light to produce the image.

35. A display as in Claim 34 wherein the image-producing component employs line-at-at-time activation for updating the imaging lines.

36. A display as in Claim 34 wherein the light-emitting diode display is of organic type.

37. A display as in Claim 34 wherein the further display in the image-producing component comprises:

a liquid-crystal device; and

a phosphor-based light-emitting device which selectively emits light when excited by light provided by the liquid-crystal device.

38. A display as in Claim 34 wherein the further display in the image-producing component comprises:

a light-providing portion;

an electron-emitting portion which emits electrons upon being excited by light furnished by the light-providing portion; and

a phosphor-based light-emitting device which selectively emits light when struck by electrons emitted by the electron-emitting portion.

39. A display as in Claim 38 wherein the light-providing portion comprises an electroluminescent device.

40. A display as in Claim 1 wherein the imaging lines extend largely parallel to one another, whereby the shutter strips extend largely parallel to one another.

41. A display as in Claim 1 wherein the shutter strips comprise parts of a liquid-crystal structure.

42. A display as in Claim 41 wherein the liquid-crystal structure contains liquid-crystal material capable of being controlled to selectively transmit an image defined by unpolarized light incident on the liquid-crystal material.

43. A display as in Claim 41 wherein the liquid-crystal material comprises:

host liquid-crystal material; and

guest pleochroic dye having selectively presentable largely black and largely transparent appearance conditions.

44. A display as in Claim 43 where the guest pleochroic dye comprises long molecules which roughly align with long molecules of the host liquid-crystal material.

45. A display as in Claim 43 wherein:

the host liquid-crystal material comprises cholesteric liquid crystal; and

the guest pleochroic dye comprises black dichroic dye.

46. A display as in Claim 45 wherein part of the liquid-crystal material is present in each shutter strip and, when that shutter strip is in its light-absorptive state, has a cholesteric twist of at least 180°.

47. A display as in Claim 46 wherein the cholesteric twist of each shutter strip in its light-absorptive state is at least 360°.

48. A display as in Claim 46 wherein the cholesteric twist of each shutter strip in its light-absorptive state has a twist pitch of no more than 5 μm.

49. A display as in Claim 48 wherein the twist pitch of each shutter strip in its light-absorptive state is no more than 3 μm.

50. A display as in Claim 46 wherein the liquid-crystal material is no more than 10 μm in thickness.

51. A display as in Claim 46 wherein the black dichroic dye has a concentration of 0.1 - 10 wt % in the host liquid-crystal material

52. A display as in Claim 51 wherein the concentration of the black dichroic dye is 0.5 - 5 wt %.

53. A display as in Claim 43 wherein:

the host liquid-crystal material comprises encapsulated polymer-dispersed liquid crystal; and

the guest pleochroic dye comprises black dichroic dye.

54. A display as in Claim 41 wherein each shutter strip in the liquid-crystal structure comprises:

a different corresponding one of a set of laterally separated first electrical conductors;

a portion, situated opposite the corresponding first conductor, of a second electrical conductor spaced apart from the first conductor; and

liquid-crystal material situated between the corresponding first conductor and the portion of the second conductor.

55. A display as in Claim 1 wherein the display has an aspect ratio of average lateral dimension to maximum thickness of at least 4.

56. A display as in Claim 1 wherein the image-producing device is matrix addressed.

Sub B4

57. A display comprising:

an image-producing component having a multiplicity of imaging lines for producing an image, each imaging line being regularly updated to provide light that produces part of the image, largely all of each such image part being displayed simultaneously; and

a set of shutter strips, each (a) associated with at least one of the imaging lines, (b) situated in front of each so-associated imaging line outside the image-producing component, and (c) being switched during operation of the display between a light-transmissive state and a light-absorptive state such that each shutter strip is in its light-transmissive state at least partly while each imaging line associated with that strip is providing light for creating the image.

58. A display as in Claim 57 wherein each shutter strip (a) transmits at least a portion P_{T-TS} of incident visible light provided from each imaging line associated with that strip when it is in its light-transmissive state and (b) absorbs at least a portion P_{A-AS} of incident visible light provided from outside the display when that strip is in its light-absorptive state, $P_{T-TS} + P_{A-AS}$ being greater than 1.

59. A display as in Claim 57 wherein:

the imaging lines are regularly updated in response to a multiplicity of selection signals; and

the shutter strips switch between their light-transmissive and light-absorptive states largely in response to the selection signals or/and at least one selection generation signal utilized in generating the selection signals.

60. A display comprising:

an image-producing component in which a pair of plate structures are spaced apart from, and extend generally parallel to, each other, the image-producing component having a multiplicity of imaging lines for producing an image, each imaging line being regularly updated to provide light that produces part of the image; and

a set of shutter strips, each (a) associated with at least one of the imaging lines, (b) situated in front of each so-associated imaging line outside the image-producing component, and (c) being switched during operation of the display between a light-transmissive state and a light-absorptive state, each shutter strip being in its light-transmissive state at least partly while each imaging line associated with that strip is providing light for creating the image.

61. A display as in Claim 60 wherein each shutter strip (a) transmits at least a portion P_{T-TS} of incident visible light provided from each imaging line associated with that strip when it is in its light-transmissive state and (b) absorbs at least a portion P_{A-AS} of incident visible light provided from outside the display when that strip is in its light-absorptive state, $P_{T-TS} + P_{A-AS}$ being greater than 1.

62. A display as in Claim 60 wherein:

the imaging lines are regularly updated in response to a multiplicity of selection signals; and

the shutter strips switch between their light-transmissive and light-absorptive states largely in response to the selection signals or/and at least one selection generation signal utilized in generating the selection signals.

63. A display as in Claim 60 wherein the image-producing component comprises one of:

a generally flat cathode-ray tube display in which the structures respectively comprise an electron-emitting device and a light-emitting device;

a generally flat liquid-crystal display in which liquid-crystal material is situated between the plate structures; and

a generally flat plasma display in which a plasma is generated between the plate structures; and, aside from the preceding displays,

a further generally flat display in which phosphor of the imaging lines is situated in one of the plate structures and selectively emits light to produce the image.

64. A display as in Claim 63 wherein the other plate structure in the further display comprises a liquid-crystal device.

65. A display as in Claim 64 wherein the other plate structure in the further display comprises:

a light-providing portion; and

an electron-emitting portion which emits electrons upon being excited by light furnished by the light-providing portion.

66. A display comprising:

an image-producing component having a multiplicity of imaging lines for producing an image, each imaging line being regularly updated to provide light that produces part of the image;

a set of shutter strips, each (a) associated with at least one of the imaging lines, (b) situated in front of each so-associated imaging line outside the image-producing component, and (c) being switched

during operation of the display between a light-transmissive state and a light-absorptive state; and

a control component that utilizes light in causing the shutter strips to be selectively placed in their light-transmissive and light-absorptive states.

67. A display as in Claim 66 wherein each shutter strip (a) transmits at least a portion $P_{T\text{-}TS}$ of incident visible light provided from each imaging line associated with that strip when it is in its light-transmissive state and (b) absorbs at least a portion $P_{A\text{-}AS}$ of incident visible light provided from outside the display when that strip is in its light-absorptive state, $P_{T\text{-}TS} + P_{A\text{-}AS}$ being greater than 1.

SUB A4 CONT'L.

68. A display as in Claim 67 wherein each shutter strip transmits up to a portion $P_{T\text{-}AS}$ of incident visible light provided from outside the display, $P_{T\text{-}TS} - P_{T\text{-}AS}$ being at least 0.1.

69. A display as in Claim 66 wherein each shutter strip outwardly appears dark when it is in its light-absorptive state.

SUB B5

70. A display as in Claim 66 wherein largely all of the image part produced by the light provided by each imaging line is displayed largely simultaneously.

71. A display as in Claim 66 wherein the control component comprises a group of control elements for selectively providing light that determines placement of the shutter strips in their light-transmissive and light-absorptive states.

72. A display as in Claim 71 wherein each control element is operable to provide light that causes an

associated one of the shutter strips to be in a specified one of its light-transmissive and light-absorptive states.

73. A display as in Claim 72 wherein each shutter strip is in its light-transmissive state largely while each control element associated with that strip provides light of at least a threshold value.

74. A display as in Claim 73 wherein, during operation of the display, at least one of the shutter strips is in its light-absorptive state largely while each control element associated with that strip does not provide light of at least the threshold value.

75. A display as in Claim 66 wherein:

each imaging line is selectively activated to provide light which produces that imaging line's part of the image; and

each shutter strip is in its light-transmissive state at least largely while each imaging line associated with that strip is activated.

76. A display as in Claim 75 wherein, during normal operation of the display, each shutter strip is also in its light-transmissive stage largely when each activated imaging line associated with that strip is essentially fully black.

77. A display as in Claim 75 wherein, during operation of the display, a variably selectable plurality of consecutive ones of the shutter strips are simultaneously in their light-transmissive states when at least one other of the shutter strips is in its light-absorptive state.

78. A display as in Claim 77 wherein the selectable plurality of shutter strips are simultaneously in their light-transmissive states when a variably selectable one of the imaging lines associated with that plurality of shutter strips is activated and each other imaging line associated with that plurality of shutter strips is deactivated.

SUB AS CONCL

79. A display as in Claim 74 wherein:

each imaging line is activated in response to a different corresponding one of a multiplicity of selection signals; and

the control elements are responsive to the selection signals, or/and at least one selection generation signal utilized in generating the selection signals, for selectively providing light that causes the shutter strips to be selectively placed in their light-transmissive and light-absorptive states.

80. A display as in Claim 79 wherein:

each imaging line becomes activated when the corresponding selection signal goes to a selection condition and becomes deactivated when the corresponding selection signal leaves its selection condition;

no more than part of the selection signals are simultaneously at their selection conditions at any time during normal operation of the display; and

each control element emits light, and the associated shutter strip is in its light-transmissive state, at least largely while the selection signal for each imaging line associated with that strip is at that selection signal's selection condition.

SUB AG CONT'D

81. A display as in Claim 80 wherein substantially only one of the selection signals is at

SUBAG CONCL.

that selection signal's activation condition during normal operation of the display.

82. A display as in Claim 80 wherein the imaging lines and control elements emit light in response to radiation that impinges on light-emissive material of the imaging lines and control elements.

83. A display as in Claim 82 wherein the light-emissive material comprises phosphor.

84. A display as in Claim 80 wherein one of the shutter strips is in its light-transmissive state while (a) the selection signal for each imaging line associated with that strip is not at that signal's selection condition and (b) no control element associated with that strip emits significant light.

85. A display as in Claim 80 wherein the light provided by the control elements comprises part of the light provided by the imaging lines.

86. A display as in Claim 71 wherein each imaging line comprises a line of laterally separated imaging elements.

87. A display as in Claim 86 wherein each imaging or control element is light emissive.

88. A display as in Claim 87 wherein each imaging or control element emits light in response to radiation that impinges selectively on light-emissive material of that imaging or control element.

89. A display as in Claim 88 wherein the radiation comprises electrons.

90. A display as in Claim 87 wherein each imaging or control element emits light in response to a potential across that imaging or control element.

91. A display as in Claim 86 wherein each imaging or control element comprises a light valve.

92. A display as in Claim 91 wherein each light valve includes means for providing light selectively transmitted by that light valve.

93. A display as in Claim 66 wherein:

the imaging lines are regularly updated in response to a multiplicity of selection signals; and

the shutter strips switch between their light-transmissive and light-absorptive states largely in response to the selection signals or/and at least one selection generation signal utilized in generating the selection signals.

94. A display as in Claim 93 wherein each imaging line continues to produce its updated part of the image largely until that imaging line's part of the image is updated again.

95. A display as in Claim 66 wherein the shutter strips comprise parts of a liquid-crystal structure.

96. A display as in Claim 95 wherein the liquid-crystal structure contains liquid-crystal material capable of being controlled to selectively transmit an image defined by unpolarized light incident on the liquid-crystal material.

Sub C10

97. A display as in Claim 96 wherein the liquid-crystal material comprises:

host liquid-crystal material; and

guest pleochroic dye having selectively presentable largely black and largely transparent appearance conditions.

SUB A7 CONCL.

98. A display as in Claim 96 wherein:

the host liquid-crystal material comprises cholesteric liquid crystal; and

the guest pleochroic dye comprises black dichroic dye.

99. A display as in Claim 98 wherein part of the liquid-crystal material is present in each shutter strip and, when that shutter strip is in its light-absorptive state, has a cholesteric twist of at least 180°.

100. A display as in Claim 99 wherein the cholesteric twist of each shutter strip in its light-absorptive state is at least 360°.

101. A display as in Claim 99 wherein the cholesteric twist of each shutter strip in its light-absorptive state has a twist pitch of no more than 5 μm.

102. A display as in Claim 101 wherein the twist pitch of each shutter strip in its light-absorptive state is no more than 3 μm.

Sub B16

103. A display as in Claim 99 wherein the liquid-crystal material is no more than 10 μm in thickness.

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CONCL.

104. A display as in Claim 99 wherein the black dichroic dye has a concentration of 0.1 - 10 wt % in the host liquid-crystal material

105. A display as in Claim 104 wherein the concentration of the black dichroic dye is 0.5 - 5 wt %.

106. A display as in Claim 95 wherein each shutter strip in the liquid-crystal structure comprises:

a different corresponding one of a set of laterally separated first electrical conductors;

a portion, situated opposite the corresponding first conductor, of a second electrical conductor spaced apart from the first conductor; and

liquid-crystal material situated between the corresponding first conductor and the portion of the second conductor.

SUB E4

107. A display as in Claim 106 wherein, in addition to the shutter strips, the liquid-crystal structure includes:

a third electrical conductor; and

a group of switches physically connected to the third conductor, each switch physically connected to a different corresponding one of the first conductors and being operable to electrically couple the corresponding first conductor to the third conductor when sufficient light from an associated one of the control elements strikes that switch or to electrically decouple the corresponding first conductor from the third conductor when sufficient light from an associated one of the control elements strikes that switch.

108. A display as in Claim 107 wherein each switch comprises light-sensitive material that (a) goes from a

specified one of an electrically insulating condition and an electrically conductive condition to the other of the conditions when struck by sufficient light of a specified type and (b) returns to the specified condition when not being struck by sufficient light of the specified type.

109. A display as in Claim 108 wherein the specified condition is the insulating condition whereby the light-sensitive material goes from the insulating condition to the conductive condition when struck by sufficient light of the specified type.

110. A display as in Claim 108 wherein the light-sensitive material comprises amorphous semiconductor material.

SUB A9 CONCL.

111. A display as in Claim 108 wherein the first and third conductors are spaced laterally apart from one another.

112. A display as in Claim 108 wherein the first and third conductors are spaced vertically apart from each other largely opposite the associated control element.

113. A display as in Claim 112 wherein the third conductor is light reflective.

114. A display as in Claim 107 wherein each switch comprises a phototransistor.

SUB B7

115. A display as in Claim 66 wherein the image-producing component has first and second plate structures spaced apart from, and extending generally parallel to, each other in an active display region.

116. A display as in Claim 115 wherein the image-producing component comprises a generally flat cathode-ray tube in which the first and second plate structures respectively comprise an electron-emitting device and a light-emitting device.

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117. A display as in Claim 104 wherein:

each imaging line comprises a line of laterally separated light-emissive imaging elements of the light-emitting device; and

the electron-emitting device emits electrons that selectively strike the light-emissive imaging elements and cause them to emit light that produces the image.

118. A display as in Claim 66 wherein the image-producing component comprises one of:

a generally flat cathode-ray tube display;

a generally flat liquid-crystal display;

a generally flat plasma display;

a generally flat electroluminescent display;

a generally flat light-emitting diode display;

a laser-written display;

a front-illuminated projection screen;

a rear-illuminated projection screen; and, aside from the preceding displays and screens,

a further generally flat display in which the imaging lines comprise phosphor that selectively emits light to produce the image.

119. A display as in Claim 118 wherein the image-producing component employs line-at-a-time activation for updating the imaging lines.

120. A display as in Claim 119 wherein the light-emitting diode display is of organic type.

121. A display as in Claim 118 wherein the further display in the image-producing component comprises:

a liquid-crystal device; and

a phosphor-based light-emitting device which selectively emits light when excited by light provided by the liquid-crystal device.

122. A display as in Claim 118 wherein the further display in the image-producing component comprises:

a light-providing portion;

an electron-emitting portion which emits electrons upon being excited by light furnished by the light-providing portion; and

a phosphor-based light-emitting device which selectively emits light when struck by electrons emitted by the electron-emitting portion.

123. A display as in Claim 122 wherein the light-providing portion comprises an electroluminescent device.

124. A display as in Claim 66 wherein the imaging lines extend largely parallel to one another, whereby the shutter strips extend largely parallel to one another.

Sub B8

125. A method comprising the following steps for manufacturing a flat-panel display:

forming an image-producing flat-panel component having a multiplicity of imaging lines for producing an image such that each imaging line is regularly updatable to provide light that produces part of the image;

forming a shutter comprising a set of shutter strips; and

placing the shutter over the image-producing component so that each shutter strip is (a) associated with at least one of the imaging lines, (b) situated in front of each so-associated imaging line outside the image-producing component, and (c) switchable during display operation between a light-transmissive state and a light-absorptive state such that each shutter strip is in its light-transmissive state at least partly while each imaging line associated with that strip is providing light for creating the image.

126. A method as in Claim 125 wherein the first-mentioned forming step comprises assembling first and second plate structures together through an outer wall to form the image-producing component.

Sub B9

127. A method comprising the steps of:

producing an image by regularly updating each of a multiplicity of imaging lines of an image-producing flat-panel component to provide light that produces part of the image; and

switching each of a set of shutter strips, each associated with at least one of the imaging lines and being situated in front of each so-associated imaging line outside the image-producing component, between a light-transmissive state and a light-absorptive state such that each shutter strip is in its light-transmissive state at least partly while each imaging line associated with that strip is providing light for creating the image.

128. A method as in Claim 127 wherein:

the producing step involves regularly updating the imaging lines in response to a multiplicity of selection signals; and

the switching step involves switching the shutter strips between their light-transmissive and light-absorptive states largely in response to the selection signals or/and at least one selection generation signal utilized in generating the selection signals.

129. A method comprising the steps of:

producing an image by regularly updating each of a multiplicity of imaging lines of an image-producing component to provide light that produces part of the image;

switching each of a set of shutter strips, each associated with at least one of the imaging lines and being situated in front of each so-associated imaging line outside the image-producing component, between a light-transmissive state and a light-absorptive state; and

utilizing light to cause the shutter strips to be selectably placed in their light-transmissive and light-absorptive states.

130. A method as in Claim 129 wherein:

the producing step involves regularly updating the imaging lines in response to a multiplicity of selection signals; and

the switching and utilizing steps involve providing light, which causes the shutter strips to be selectively placed in their light-transmissive and light-absorptive states, in response to the selection signals or/and at least one selection generation signals utilized in generating the selection signals.